

Request #465: EMFAC2002 On-Road Winter Season Carbon Monoxide Inventories and Vehicle Activity Estimates for CO Maintenance Areas

AQTPB requested on-road mobile carbon monoxide (CO) emissions inventories, winter season for calendar years 1993, 2003, 2010, and 2018, for the upcoming revision to the CO Maintenance Plan. The inventories are for the following areas: Butte County; the Placer and El Dorado County portions of the Lake Tahoe Air Basin; the Sacramento Valley Air Basin portions of Sacramento, Placer and Yolo counties; San Diego County; all nine counties of the San Francisco Bay Area Air Basin; and the Kern County, Fresno County, Stanislaus County, and San Joaquin County portions of the San Joaquin Valley Air Basin.

Note that EMFAC does not provide emissions estimates for areas within the specific boundaries of the federally designated CO maintenance areas, but provides estimates down to the county level or the air basin portion of a county level. In keeping with past practice, emission inventories and budgets are proposed for these larger areas rather than being limited to metropolitan or urbanized areas.

Emissions from off-road mobile, area and stationary sources are also needed for the CO plan, but are not included in this report.

Methodology

Emissions were estimated using EMFAC2002 version 2.2 (Apr03). Model default estimates were provided for all counties for year 1993, and for Sacramento, Placer and El Dorado counties for all years. Default estimates were also provided for the San Joaquin Valley Counties for year 2003. For remaining years and areas, updated vehicle activity was used to develop the inventories. The basis for that activity is described by area in the following pages.

Bay Area

To develop CO Plan emissions inventories for the Bay Area, staff ran EMFAC2002 version 2.2 (Apr03) for the winter season. Default motor vehicle activity was used for CY 1993 estimates. For CYs 2003, 2010, and 2018, the model was run using a script developed with the assistance of the Atmospheric Modeling Support Section. Bay Area activity was estimated for a broad range of calendar years.

VMT. The Air Resources Board (ARB) received updated VMT and speed distributions in June 2003 from MTC. MTC provided VMT data by county for calendar years 1998 (from ABAG's socio-economic forecast, Projections 2000), 2000 (Projections 2002), 2006 (Projections 2002), and 2010 (Projections 2002). We calculated annual compounded growth rates¹ between these calendar years for each of the nine counties.

¹ $(\text{Last Value} / \text{First Value})^{(1/n)}$

ARB staff ran EMFAC2002 for calendar year 1999 by subarea for the San Francisco Air Basin (SFAB).² Per previous agreement with MTC, EMFAC2002 provided the VMT for the base year 1999. Staff then grew EMFAC's 1999 VMT using the growth rates developed from the MTC data. New VMT were estimated in this manner for calendar years 2000, 2001, 2002, 2003, 2005, 2006, 2007, 2008, 2010, 2012, 2018, 2020, and 2025.

For example, the annual compounded growth rates between MTC 1998 data and MTC 2000 data determined the growth between 1999 and 2000 for each county. These rates were used to grow EMFAC 1999 VMT to produce the new 2000 VMT. Similarly, the growth between MTC 2000 data and MTC 2006 data was used to produce new VMT estimates for years 2001, 2002, 2003, and 2005. MTC data for 2006 and 2010 were used to produce new VMT for 2007 and 2008 as well as for all years beyond 2010. The VMT for 1990 and 1993 were taken from the EMFAC model defaults.

Staff added an enhanced Inspection and Maintenance (I/M) program to the EMFAC model input files using the model's scenario generator (WIS). We assumed that full implementation of the Enhanced I/M program begins in January 2004 and included acceleration simulation mode (ASM) testing and interim cut-points. We assumed the program applies to light-duty cars and trucks, medium-duty vehicles, and heavy-duty gasoline trucks up to 14,000 lbs. GVWR.

Vehicle Population. Because the EMFAC model uses vehicle population and mileage accrual rates to calculate VMT, the VMT was adjusted through the vehicle population inputs in the WIS. Vehicle population for each county was factored by the ratio of re-estimated VMT to EMFAC default VMT (per *Recommended Methods for Use of EMFAC2002 to Develop Motor Vehicle Emissions Budgets and Assess Conformity*, found at <http://www.arb.ca.gov/planning/sip/emfac2002/emfac2002.htm>). Adjusting the VMT in this manner avoids the underestimation of evaporative emissions.

Speeds. MTC provided new speed distributions for calendar years 2000, 2006, and 2010 based on Projections 2002. Year 2006 speeds were applied to years 2001, 02, 03, 05, and 06. Year 2010 speeds were applied to 2007, 2008, and 2010. EMFAC2002 default speed distributions were applied to years beyond 2010. The model's speed defaults are based on MTC's submittal in April 2002. Speeds for calendar years 1990, 1993, and 1999 are also EMFAC model defaults, though based on previous MTC submittals. The speed distributions were evaluated to insure that they represented changes in speed that were reasonable from one year to the next.

San Joaquin Valley

VMT. ARB staff ran EMFAC2002, Version 2.2 (Apr03), winter, by county for calendar years 1993 and 2003 using model default VMT. For calendar years 2010 and 2018, we adjusted VMT to reflect data provided by the Valley's transportation planning agencies (TPAs) February 28, 2002, and September 2, 2003 for Kings and Stanislaus counties. We interpolated TPA VMT data linearly to develop appropriate model inputs for years for which TPA data were not provided.

Vehicle Population. As with the Bay Area, the VMT was adjusted by changing the vehicle population used in the model. Vehicle population for each county was adjusted by the ratio of COG VMT to EMFAC default VMT.

² Air basins may contain only portions of some counties. These partial counties are estimated in subarea model runs.

Speeds. EMFAC2002 contains the speed distributions most recently provided by San Joaquin Valley TPAs; no adjustments were made.

San Diego

Model default estimates were used for calendar year 1993. SANDAG provided EMFAC input files to reflect most recent forecasts of VMT and speed distribution for calendar years 2003 and 2010. Calendar year 2018 VMT was altered through a proportional adjustment to 2018 vehicle population. The vehicle population input was obtained through linear interpolation between calendar year 2014 and 2020 vehicle populations, from 2014 and 2020 EMFAC input files provided by SANDAG. SANDAG provided EMFAC input files for CY 2003 on March 10, 2004, and for the other years on December 15, 2003. The files are consistent with those previously submitted and reviewed by ARB staff for the region's ozone maintenance plan.

Lake Tahoe

The Tahoe Regional Planning Agency (TRPA) is the transportation planning agency for the Lake Tahoe Air Basin. Staff from ARB and TRPA discussed extensively the collection and use of travel activity specific to the basin, as well as appropriate temperature inputs. Below is a summary of the data sources agreed upon for use in the CO Plan. Additional documentation as developed by TRPA in consultation with ARB and submitted April 27, 2004 is available. TRPA staff used the new activity and temperature data in EMFAC2002 version 2.2 (Apr03) through the model's WIS utility.

VMT. TRPA has not yet completed work on a new travel demand model for the Tahoe basin, so the Agency's current VMT estimates are based on historical and current traffic counts, past model estimates, and other factors such as the number of employment and tourist attractions within each county. Unfortunately, this method can not account for the VMT generated by an attraction in one county that heavily impacts another. Upon review of the default EMFAC2002 VMT data, TRPA staff felt that the higher VMT growth rates in the model better reflect expected growth in travel in the Tahoe basin. TRPA's current estimates likely underestimate VMT for both California counties, since the impacts from growth in adjacent areas are not taken into consideration and the Tahoe area is overwhelmingly impacted by vehicles from outside the Basin. Staff from both agencies agreed that using the default EMFAC2002 data for VMT was appropriate.

Vehicle Population/Fleet Mix. Because the VMT estimates were left at default values, no adjustment to the number of vehicles in the basin was necessary. However, the region's unique location and status as a destination for winter sports and resort activities result in significant numbers of visitors from both in and out of California to the Lake Tahoe area. Since these winter visitors often drive vehicles heavier than the average vehicle fleet, TRPA staff undertook a video survey data collection effort to quantify the fleet mix in the basin during the winter months. The resulting data were used to adjust the percentages of each vehicle class making up the total vehicle population. Note that these adjustments did not change the total number of vehicles, but did alter the relative weights of each vehicle class in the fleet.

Speeds. The roadway network in the Lake Tahoe basin is unique as well. During the same data collection effort that collected fleet mix information, data on speeds traveled on various road types was gathered. This information was used with estimates of the portions of travel on each type of road to generate estimates of speeds traveled in the basin during the winter season. This speed distribution information was used in the EMFAC2002 estimation of winter CO emissions.

Temperatures. Carbon monoxide emissions increase sharply with lower temperatures. The default temperatures in EMFAC2002 do not appropriately reflect winter conditions for the basin. TRPA staff gathered temperature data from the air monitoring site on Sandy Way in South Lake Tahoe for dates in recent years when violations of the state standard were recorded. These data were subsequently reviewed by ARB staff and used in the WIS runs to estimate CO emissions in the region.

Butte County

VMT and speeds. The Butte County Association of Governments (BCAG) is the transportation planning agency for Butte County, and maintains a travel demand model for the county. BCAG provided VMT and speed distribution information for the years 2000, 2010, 2015, 2020, and 2025 for use in the CO Maintenance Plan, and requested that ARB use this data in a letter dated February 24, 2004. ARB staff calculated VMT for years 2003 and 2018 through interpolation, and used default activity for 1993. Speed distributions provided by BCAG were the basis for those used in the CO Plan; in consultation with BCAG staff, the distributions from the nearest years provided by BCAG were applied to CO Plan years. For example, to estimate 2003 emissions, VMT was interpolated from the 2000 and 2010 estimates provided by BCAG, while the speed distribution for 2003 was assumed to be the 2000 distribution provided by BCAG.

Caltrans assistance. Because BCAG travel model output was not in the summary format needed for EMFAC, BCAG provided the output to Caltrans, who summarized the data and provided it to ARB staff. After ARB review, the data were used in EMFAC2002 through the WIS utility. As with other areas and consistent with our recommended procedures for adjusting activity, vehicle population was adjusted to arrive at the desired VMT levels.

Results

The following tables provide summaries of VMT used in the model runs, and the resulting CO emissions inventory.

June 29, 2004

Vehicle Miles Traveled for Ten CO Maintenance Areas (thousands)

	<u>1993</u>	<u>2003</u>	<u>2010</u>	<u>2018</u>
Bakersfield (Kern County portion of the San Joaquin Valley Air Basin)	11,635	16,364	20,868	26,409
Chico (Butte County)	4,401	4,861	5,751	6,954
Fresno (Fresno County portion of the San Joaquin Valley Air Basin)	15,987	20,624	24,895	29,487
Lake Tahoe North Shore (Placer County portion of Lake Tahoe Air Basin)	369	480	599	715
Lake Tahoe South Shore (El Dorado County portion of Lake Tahoe Air Basin)	598	695	887	1,134
Modesto Urbanized Area (Stanislaus County portion of the San Joaquin Valley Air Basin)	9,068	11,447	13,344	15,802
Sacramento Area (three counties of Sacramento Valley Air Basin)	34,421	40,881	47,276	53,186
Placer	4,326	6,902	8,373	9,791
Sacramento	26,310	29,042	33,091	36,608
Yolo	3,785	4,937	5,812	6,787
San Diego (San Diego County)	66,110	81,332	90,907	95,819
San Francisco-Oakland-San Jose Area (nine counties of San Francisco Air Basin)	140,124	169,852	188,671	211,449
Alameda	29,329	35,164	39,552	45,426
Contra Costa	20,595	25,783	29,631	34,389
Marin	5,863	6,964	7,595	8,325
Napa	2,490	3,282	3,726	4,101
San Francisco	11,774	13,231	13,924	14,461
San Mateo	19,252	22,883	24,223	25,590
Santa Clara	37,370	45,921	50,856	57,063
Solano	5,692	6,969	8,348	10,080
Sonoma	7,759	9,655	10,816	12,014
Stockton (San Joaquin County portion of San Joaquin Valley Air Basin)	12,193	16,052	19,810	23,738

Source: Emfac 2002 v2.2 (April 2003) with RTPA activity updates

June 29, 2004

On-Road Carbon Monoxide Emissions (Winter) for Ten CO Maintenance Areas (tons/day)

	<u>1993</u>	<u>2003</u>	<u>2010</u>	<u>2018</u>
Bakersfield (Kern County portion of the San Joaquin Valley Air Basin)	347.0	177.3	112.0	65.6
Chico (Butte County)	138.3	75.2	46.0	22.6
Fresno (Fresno County portion of the San Joaquin Valley Air Basin)	449.9	235.6	140.7	77.5
Lake Tahoe North Shore (Placer County portion of Lake Tahoe Air Basin)*	17.5	10.3	7.2	4.1
Lake Tahoe South Shore (El Dorado County portion of Lake Tahoe Air Basin)*	31.9	18.0	12.5	7.0
Modesto Urbanized Area (Stanislaus County portion of the San Joaquin Valley Air Basin)	246.1	126.4	74.1	42.2
Sacramento Area (three counties of Sacramento Valley Air Basin)	857.3	410.3	243.9	133.8
Placer	107.4	65.2	40.0	22.4
Sacramento	655.5	299.7	177.0	96.1
Yolo	94.4	45.4	26.8	15.3
San Diego (San Diego County)	1,471.8	728.3	456.6	249.1
San Francisco-Oakland-San Jose Area (nine counties of San Francisco Air Basin)	3,314.3	1,840.1	978.8	562.9
Alameda	692.9	378.8	198.7	118.9
Contra Costa	487.6	269.8	148.5	86.5
Marin	147.5	80.4	43.2	24.5
Napa	68.2	43.4	22.6	11.9
San Francisco	275.7	158.9	84.5	48.8
San Mateo	432.9	223.6	118.2	64.8
Santa Clara	864.5	482.5	255.7	150.2
Solano	137.0	74.1	42.0	22.8
Sonoma	208.1	128.8	65.5	34.6
Stockton (San Joaquin County portion of the San Joaquin Valley Air Basin)	326.4	161.5	97.2	55.0

Source: *Emfac 2002 v2.2 (April 2003) with RTPA activity updates*